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The Patent Office
Concept House
Cardiff Road
Newport
South Wales
NP10 8QQ

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Signed A W Bennett.

Dated 11 October 2000

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18 MAY 2000

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19[redacted] E538254-1 D00041
P01/7700 0.00-0012085.7

Request for grant of a patent

(See the notes on the back of this form. You can also get an explanatory leaflet from the Patent Office to help you fill in this form)

The Patent Office

Cardiff Road
Newport
South Wales
NP9 1RH

1. Your reference — REP06051GBB

2. Patent application number *(The Patent Office will fill in this part)* — 18 MAY 2000 — 0012085.7

3. Full name, address and postcode of the or of each applicant *(underline all surnames)*

Freudenberg Ltd.
P.O. Box 3
Ellistones Lane
Greetland
halifax
West Yorkshire HX4 8NJ

Patents ADP number *(if you know it)*

If the applicant is a corporate body, give the country/state of its incorporation — United Kingdom

7754 23700

4. Title of the invention — NON-WOVEN ABRASIVE MATERIAL

5. Name of your agent *(if you have one)* — Gill Jennings & Every

"Address for service" in the United Kingdom to which all correspondence should be sent *(including the postcode)*

Broadgate House
7 Eldon Street
London
EC2M 7LH

Patents ADP number *(if you know it)* — 745002

6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and *(if you know it)* the or each application number

Country	Priority application number *(if you know it)*	Date of filing *(day / month / year)*

7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application

Number of earlier application	Date of filing *(day / month / year)*

8. Is a statement of inventorship and of right to grant of a patent required in support of this request? *(Answer 'Yes' if:*

a) any applicant named in part 3 is not an inventor, or
b) there is an inventor who is not named as an applicant, or
c) any named applicant is a corporate body.
See note (d))

YES

Patents Form 1/77

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Continuation sheets of this form	
Description	6
Claim *(s)*	1
Abstract	
Drawing *(s)*	

16

10. If you are also filing any of the following, state how many against each item.

Priority documents	
Translations of priority documents	
Statement of inventorship and right to grant of a patent *(Patents Form 7/77)*	
Request for preliminary examination and search *(Patents Form 9/77)*	
Request for substantive examination *(Patents Form 10/77)*	
Any other documents *(please specify)*	NO

11. For the applicant
Gill Jennings & Every

I/We request the grant of a patent on the basis of this application.

Signature: [signature] Date: 18 May 2000

12. Name and daytime telephone number of person to contact in the United Kingdom

PERRY, Robert Edward
020 7377 1377

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Notes

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NON-WOVEN ABRASIVE MATERIAL

Field of the Invention

This invention relates to non-woven abrasive materials.

Background to the Invention

Non-woven abrasive materials are well known. They are typically manufactured from polyamide fibres (such as Nylon 6 or Nylon 66), and include a binder such as phenol-formaldehyde (PF) resin.

Most known non-woven abrasive products can be reshaped, in use, by a user, but are unable to maintain that shape. Non-woven abrasive products have been developed that may partially retain a user-defined shape.

Non-woven abrasive materials of the type discussed above are typically sold in pads of a predetermined size. In the alternative, they are sold as rolls; the user may either cut or tear off the required amount, and tearing may be facilitated by the rolls' being perforated at predetermined intervals.

US-A-4355067 discloses a fibrous scouring material. US-A-5712210 discloses a non-woven abrasive material roll.

Summary of the Invention

According to a first aspect of the present invention, an abrasive material comprises non-woven, synthetic fibres, and is deformable, and is able to maintain the deformed shape.

According to a second aspect of the present invention, the abrasive material is in the form of a wad of strips.

According to a third aspect of the present invention, a method of manufacturing strips of a non-woven abrasive material comprises the steps of:

(i) spraying a non-woven fleece with resin and a binder;

(ii) spreading the sprayed fleece with abrasive grains;

(iii) curing the resin; and

(iv) shredding the cured fleece.

According to a fourth aspect of the present invention, a method of manufacturing a non-woven, abrasive material comprises the steps of:

(i) spraying a non-woven fleece with resin and a binder;

(ii) spreading the sprayed fleece with abrasive grains;

(iii) curing the resin; and

(iv) passing the cured fleece through a willying machine.

A material of the present invention is useful in a number of applications, for example, where a deformable abrasive material is required. Unlike preformed pads or precut rolls, the materials can be used in a variety of forms, as desired, e.g. following pinch extraction from a box or sleeve. In this way, the user may control the quantity of material dispensed for each application. In particular, the abrasive material can be separated into user-defined quantities.

Advantageously, the wad of abrasive material has a low enough tear strength to allow it to be separated into a smaller wad and a high enough tear strength to maintain its integrity as a wad or deformed wad, when in use.

Description of the Invention

The non-woven abrasive material of the present invention may be manufactured from components typically found in conventional non-woven materials, and by processes similar to those used to manufacture conventional non-woven materials. For example, a method of manufacturing the novel non-woven abrasive material of the present invention may comprise the steps of:

(i) carding staple fibres;

(ii) cross-lapping to form a fleece;

(iii) passing the fleece through a calendar roll;

(iv) spraying the fleece with resin and a filler binder;

(v) powder-spreading the fleece with abrasive grain; and

(vi) heating in a forced air oven to dry and cure the resin.

It will be obvious to one skilled in the art that alternative methods of preparing non-woven abrasive materials are known. For example, air-laying may be used, instead of carding.

A preferred additional step is:

(vii) shredding the cured fleece to produce strips.

More preferably, the fleece is longitudinally shredded, as this is easier to carry out than transverse shredding of the fleece.

The shredding may produce strips of between 2 and 10 mm width. For example, the strips may be 4 mm wide. However, it is understood that narrower

or wider variants may be used to produce the desired effect. It is further understood that any non-woven abrasive material that does not comprise a reinforcing scrim may be shredded.

Alternatively, a preferred additional step is:

(vii) passing the cured fleece through a willying machine.

Willying machines are well known in the art. They have not been applied to cured fleeces. The resultant material is an amorphous mass of cured, abrasive fibres.

The material typically has a non-planar structure, in contrast with conventional non-woven abrasive materials. The material can be shaped or "crumpled" into a desired form and has the ability to maintain the crumpled form. This feature arises from a lower degree of rigidity of the material, as compared with conventional sheets of non-woven abrasive materials, together with a tendency of non-woven abrasive materials to engage with one another.

Non-woven abrasive materials of the present invention may be manufactured from three basic elements. Fibres may be used having a fibre weight of between 30 and 300 g/m^2. Binders may be used with a binder weight of between 60 and 1000 g/m^2. Abrasive grains may be used having a weight of between 30 and 600 g/m^2.

It is understood that any synthetic staple fibre may be used, dependent on the desired use of the product and the binder system employed. Fibre deniers of between 5 and 200, or combinations thereof, may be used, dependent upon the process and also product performance requirements. The fibres typically have staple lengths of about 60 mm. This may vary, dependent on product performance and process requirements.

Abrasives such as aluminium oxide or silicon carbide may be used dependent upon the desired performance characteristics of the product. It is understood that any size, or combination thereof, of abrasive grains may be used, for example, between 36 and 1800 grit.

The following Example illustrates the invention.

Example 1

A comparison test was performed on a number of known abrasive products, to illustrate their improved "deformability" after shredding.

Freudenberg products 4223, 4370, 4480, 4650 and 3M Multiflex (™) are commercially available non-woven abrasive materials, manufactured by conventional methods.

For example, 4370 is manufactured from a fibre blend of 90% Nylon 66 60 denier fibre and 10% 20 decitex fibre. The fibres are then blended to ensure that they are evenly distributed.

The blend is opened using a willying machine and 2 disc openers, and transported by air to the card. The fibres are then processed through the card to produce a uni-directional fleece. The fleece is then passed into a crosslapper to build up layers of fleece, forming a batt of fibre weight 200 g/m^2. The batt is then passed through a pair of calender rolls, to reduce its thickness, and then needled.

The fibre batt is sprayed with an aqueous phenol formaldehyde (PF) resin and mineral filler slurry. Included in the slurry is a small percentage (<1% wt) of a pigment. Additional water is added to the slurry, to reduce its solids content and viscosity, allowing it to be sprayed. Prior to spraying, the slurry is about 70% solids. A total of 700 g/m^2 is sprayed onto the batt. The components making up the slurry are added together to give a total mix weight of about 800 kg. This is continuously agitated, to prevent the solid particles from settling. The ratio of dried resin to filler is 1:3.

The batt is passed through a forced air dryer to dry and cure the resin, and then rolled and cut, as desired. The finished weight is 900 g/m^2 and it is 12 mm thick.

Additionally, the products were longitudinally shredded to produce thin strips of material, approximately 3.8 mm width.

The following tests have been carried out to quantify the superior "crumpling" properties of the shredded products, compared to the "un-shredded" products.

The product was scrunched up by hand for 3 seconds and allowed to relax on a flat surface for a further 60 seconds. After the recover time had

elapsed, the largest and smallest dimensions were measured. This was carried out by placing the sample between two vertical parallel surfaces. The space between the surfaces was altered until the sample was in contact with both surfaces but no deformation of the sample had taken place. The sample was carefully rotated until the maximum dimension was found and measured. The process was repeated to assess the minimum dimension. The products were then shredded and the whole process repeated by scrunching the shredded samples and measuring their dimensions. Table 1 shows the results for the "un-shredded" products. Table 2 shows the results for the shredded products.

It must be noted that prior to shredding the products all had a tendency to expand after scrunching, to a greater or lesser extent. In the main they tried to recover their original flat shape. After shredding the products had a negligible tendency to expand and remained in the ball-like shape they formed when scrunched.

Table 1

	4223	4370	4480	4650	3M Multiflex (™)
Sample size (cm)	15x22x0.7	15x22x1.2	15x22x1.3	15x22x0.8	15x22x0.4
Largest dimension (cm)	26.6	26.6	26.6	26.6	18.0
Smallest dimension (cm)	0.7	1.2	1.3	0.8	0.4
Largest scrunched dimension (cm)	22.2	21.1	24.3	25.4	14.5
Smallest scrunched dimension (cm)	7.3	8.2	7.7	6.4	5.1
Dimension Ratio	3.04	2.57	3.16	3.97	2.84

Table 2

	4223	4370	4480	4650	3M Multiflex (™)
Sample size (cm)	15x22x0.7	15x22x1.2	15x22x1.3	15x22x0.8	15x22x0.4
Largest dimension (cm)	26.6	26.6	26.6	26.6	18.0
Smallest dimension (cm)	0.7	1.2	1.3	0.8	0.4
Largest shredded dimension (cm)	8.7	9.6	10.9	10.1	6.6
Smallest shredded dimension (cm)	6.4	8.1	8.4	8.5	4.8
Dimension Ratio	1.36	1.19	1.30	1.19	1.38

CLAIMS

1. An abrasive material comprising non-woven, synthetic fibres, which is deformable, and which is able to maintain the deformed shape.

2. An abrasive material according to claim 1, wherein the abrasive is in the form of grains which are held in the material by a resin or other binder.

3. An abrasive material according to claim 2, wherein the grains are of aluminium oxide.

4. An abrasive material according to any preceding claim, in the form of a body which can be separated in user-defined quantities.

5. Strips of an abrasive material according to any of claims 1 to 4.

6. Strips according to claim 5, 2 to 10 mm wide.

7. A wad of strips according to claim 5 or claim 6.

8. A wad according to claim 7, having a low enough tear strength to allow it to be separated into a smaller wad, and a high enough tear strength to maintain its integrity as a wad, when in use.

9. A method of abrading a surface, which comprises contacting the surface with an abrasive material, strips, or wad according to any preceding claim.

10. A method of manufacturing strips of a non-woven, abrasive material, comprising the steps of:

(i) spraying a non-woven fleece with resin and a binder;

(ii) spreading the sprayed fleece with abrasive grains;

(iii) curing the resin; and

(iv) shredding the cured fleece.

11. A method according to claim 10, wherein the strips are as defined in claim 5 or claim 6.

12. A method of manufacturing a non-woven, abrasive material, comprising the steps of:

(i) spraying a non-woven fleece with resin and a binder;

(ii) spreading the sprayed fleece with abrasive grains;

(iii) curing the resin; and

(iv) passing the cured fleece through a willying machine.

13. A method according to claim 12, wherein the abrasive material is as defined in any of claims 1 to 4.

PCT/GB00/03[redacted]

No filing date on 23/77 (cashier 5/10/00)

Gill Jennings + Every